

**Mark Series Position  
Indicator/Transmitter  
Installation and Operating Manual**



**PROXIMITY® Controls  
A Division of Dwyer Instruments, Inc.**

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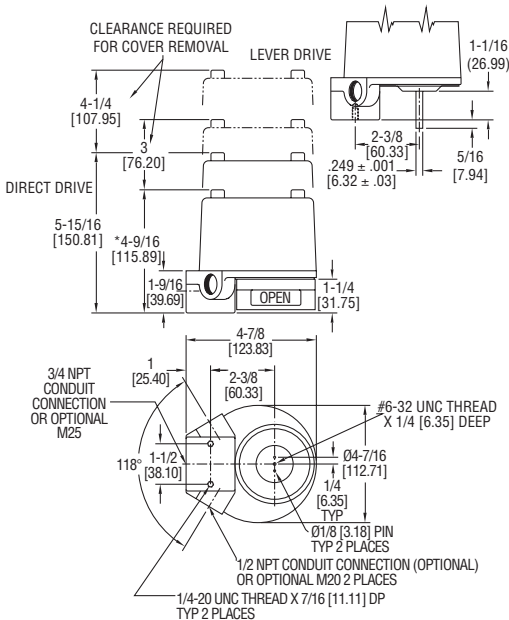
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# CONTENTS

Dimensions . . . . .	1
Introduction . . . . .	2
Specifications . . . . .	3-4
Model Number Configuration . . . . .	5-6
Junction Package . . . . .	7
Factory Sealed Leads . . . . .	7
Mounting Kits for Valves . . . . .	8
Mark 1 and 4 Direct Drive Installation . . . . .	9
Mark 1 and 4 Lever Drive Installation . . . . .	10-11
Mark 3 Direct and Lever Drive Installation . . . . .	12-13
Mark 1, 3, and 4 with Potentiometer Installation . . . . .	14
Mark 1, 3, and 4 with Transmitter Installation . . . . .	15-16
Mark 6 Direct and Lever Drive Installation . . . . .	17-18
Wiring, Intrinsic Safety and Warnings . . . . .	19-22
Maintenance . . . . .	23

## DIMENSIONS



\*FOR MODELS 11, 12, 41, 42, 61, & 62

## INTRODUCTION

The Proximity Mark Series is a line of position indicators with a selection of various output options. Four model styles make up the Mark Series to cover almost any application. A patented magnetic drive that completely seals the switch compartment from the atmosphere for maximum leak protection is utilized in the Mark 1. The Mark 3 uses the same magnetic drive of the Mark 1, but it can be used for multi-turn applications with 1 to 25 revolutions, such as gate valves. A through shaft drive is incorporated in the Mark 4 making the unit a lower cost alternative to the Mark 1 for applications that are not as demanding. Also featured in the Mark 6 is a patented magnetic design that completely seals the switch cavity. The Mark 6 offers hermetically sealed reed switches that are perfect for high cycle rate applications and low current uses such as computer and PLC control systems.

Standard models in the Mark Series have visual position indicators and are weatherproof, flameproof, and submersible. A large variety of outputs are available to fit specific applications. There is a choice of 1 to 6 switch outputs of 16 varieties including inductive sensors, high temperature switches, gold contact switches, hermetically sealed switches, and high current switches. Besides the switch outputs the Series offers potentiometer outputs and 4 to 20 mA transmitters.

The units are purchased for either direct drive applications, such as rotary valves, or lever drive applications, such as linear valves. For the Mark 1, 3, and 4 this instruction manual starts with installation of the unit to the device being monitored, and the set up of switch models. Separate instructions follow covering the potentiometer and transmitter set up if your unit has those options. The Mark 6 is covered separately in this instruction manual from the other units with it's own installation guide.

# SPECIFICATIONS

## General

### Product Ratings:

Weatherproof and flameproof. NEMA 1, 2, 3, 3R, 3S, 4, 4X, 6, 7, 9, 12, 13. (Housing styles M and N are NEMA 4, 4X only.)

UL rated: Class I, Div. 1 & 2, Groups B, C, D (Some units available for Group A, consult factory); Class II, Div. 1 & 2, Groups E, F, and G.

CSA rated: Class I, Div. 1 & 2, Groups A, B, C, D; Class II, Div. 1 & 2, Groups E, F, and G; Submersible to 50 feet.

SAA rated: -S suffix, Certified Ex d IIC T6 IP68 (15 meters).

ATEX Compliant: -B suffix, directive 94/9/EC,

KEMA 03 ATEX 2391, **CE** **Ex** II 2 G EEx d IIC T6 for  $-20^{\circ}\text{C} \leq \text{Tamb} \leq 70^{\circ}\text{C}$  and T5 for  $-20^{\circ}\text{C} \leq \text{Tamb} \leq 80^{\circ}\text{C}$  optional wording.

-IS suffix directive 94/9/EC

KEMA 03 ATEX 1392X, **CE** **Ex** II 1 G EEx ia IIC T4.

(Switch type C is not available with ATEX; Switch type B is not available with ATEX intrinsically safe, -IS suffix).

**Electrical Connections:** Screw terminal. Optional factory sealed leads that are 36" (914.4 mm) of 18 AWG.

**Conduit Connection:** 3/4" female NPT standard. Optional one or two 1/2" female NPT. M25 and M20 optional (Standard on SAA certified products).

**Mounting Orientation:** Not position sensitive.

**Weight:** 4 to 6 lb (1.5 to 3.0 kg).

**Operational Life:** over 10,000,000 cycles.

**Maximum Altitude:** 2000 meters.

**Patents:** US 4214133, 4647733, 4831350, 5357067, and other patents pending.

## Mark 1, 3, 4, and 6 with Switch Outputs

**Temperature Limits:** -65 to 180°F (-54 to 82°C). Switch Type C rated to 350°F (176°C) for 600 hours, Switch Type T rated to 250°F (121°C) continuous. (ATEX flameproof, -B suffix, rated -20°C (-4°F) to 80°C (176°F); ATEX intrinsically safe, -IS suffix, rated -20°C (-4°F) to 40°C (104°F)).

**Switch Type:** See model chart on pages 5 and 6.

**Electrical Rating:** See model chart on pages 5 and 6.

**Set Point Adjustment:** Mark 1 and 4: 5 to 360°. Mark 3: 1 to 25 revolutions. Mark 6: 45 to 180°.

### **Mark 1, 3, and 4 with Potentiometer**

**Accuracy:**  $\pm 0.5\%$  of full span. Optional  $\pm 0.25\%$  of full span.

**Temperature Limits:** -40 to 180°F (-40 to 82°C). (ATEX flameproof, -B suffix, rated -20°C (-4°F) to 80°C (176°F); ATEX intrinsically safe, -IS suffix, rated -20°C (-4°F) to 40°C (104°F)).

**Power Rating:** 1.5 Watt maximum.

**Output Signal:** 1000 Ohm standard. Optional 2000, 5000, 10000, or 20000 Ohms.

**Zero and Span Adjustments:** Span trim pot with 2000 Ohm adjustment. No zero adjustment.

**Rotational Travel:** Mark 1 and 4: Minimum: 0°, Maximum: 340°. Mark 3: 0 to 10 revolutions.

### **Mark 1, 3, and 4 with Transmitter**

**Accuracy:**  $\pm 0.5\%$  of full span. Optional  $\pm 0.25\%$  of full span.

**Temperature Limits:** -40 to 180°F (-40 to 82°C). (ATEX flameproof, -B suffix, rated -20°C (-4°F) to 80°C (176°F); ATEX intrinsically safe, -IS suffix, rated -20°C (-4°F) to 40°C (104°F)).

**Power Requirements:** 5 to 30 VDC.

**Current Consumption:** 50 mA.

**Output Signal:** 4 to 20 mA.

**Zero and Span Adjustments:** Trim pots for adjusting both. Mark 1 and 4: Span is adjustable from 50 to 300°. Mark 3: Span is adjustable from 1.5 to 8.5 revolutions.



**Conduit Connection:** 3/4" female NPT standard. Optional one or two 1/2" female NPT. M25 and M20 optional (Standard on SAA models).

**Rotational Travel:** Mark 1 and 4: Minimum: 50°, Maximum: 300°. Mark 3: Minimum: 1.5 revolutions, Maximum: 8.5 revolutions.

# MODEL CHART

Construction	1	Mark 1, Magnetic Coupling	Available Options "A" signifies available with corresponding construction style.			
	3		Mark 3, Multi-Turn	Mark		
	4			1	3	4
	6	Mark 6, Protected Reed Switch				
Output Type	1	1 Switch	A	--	A	A
	2	2 Switches	A	A	A	A
	3	Potentiometer, 1K Ohm. Available with Switch Types* B, C, I, O, R, S, V, W.	A	A	A	--
	32	Potentiometer, 2K Ohm. Available with Switch Types* B, C, I, O, R, S, V, W.	A	A	A	--
	35	Potentiometer, 5K Ohm. Available with Switch Types* B, C, I, O, R, S, V, W.	A	A	A	--
	310	Potentiometer, 10K Ohm. Available with Switch Types* B, C, I, O, R, S, V, W.	A	A	A	--
	320	Potentiometer, 20K Ohm. Available with Switch Types* B, C, I, O, R, S, V, W.	A	A	A	--
	4	4 Switches	A	A	A	--
	5	Transmitter, 4 to 20mA. Available with Switch Types* B, C, I, O, R, S, V, W.	A	A	A	--
6	6 Switches. Available with Switch Types B, C, I, R, V, W.	A	A	A	--	
7	AS-interface and 1 Switch. Available with Switch Types B, I, R, W.	A	--	A	--	
8	AS-interface and 2 Switches. Available with Switch Types B, I, R, W.	A	--	A	--	
Switch Type & Rating	A	SPDT Snap, Rated: 15A @ 125/250/480 VAC (-); 1/8 hp @ 125 VAC (-), 1/4 hp @ 250 VAC (-), 1/2A @ 125 VDC (±), 1/4A @ 250 VDC (±).	A	A	A	--
	B	Inductive Sensor. 10 to 30 VDC (±). Load: 0.1A.	A	--	A	--
	C	SPDT High Temperature Snap, 350°F (176°C) for 600 hours, Rated: 15.1A @ 125/250/277 VAC (-).	A	A	A	--
	D	DPDT Snap, Rated: 10A @ 125/250 VAC (-), 0.3A @ 125 VDC (±), 0.15A @ 250 VDC (±).	A	--	A	--
	G	SPDT Gold Contact Snap, Rated: 1A @ 125 VAC (-).	A	A	A	--
	H	SPDT Hermetically Sealed Snap, Rated: 1A @ 125 VAC (-).	A	--	A	--
	I	NAMUR Inductive Sensor. 15 mA max @ 5-25 VDC (±).	A	--	A	--
	L	SPST Hermetically Sealed Reed with LED, Rated: 0.02A @ 125 VAC (-).	--	--	--	A
	M	SPDT Magnetic Blow-Out, Rated: 10A @ 125 VAC (-) /VDC(±), 1/4 hp @ 125 VAC (-)/VDC(±).	A	A	A	--
	O	No Switches	A	A	A	--
	P	SPST Hermetically Sealed Reed, Rated: 0.15A @ 125 VAC (-), 0.15A @ 30 VDC (±); 125 VAC (-) 10W (Lamp).	--	--	--	A
	Q	SPDT Hermetically Sealed Reed, Rated: 0.15A @ 125 VAC (-), 0.15A @ 30 VDC (±).	--	--	--	A
	R	SPDT Hermetically Sealed Reed, Rated: 2A @ 125 VAC (-), 2A @ 24 VDC (±).	A	--	A	--
	S	SPDT Snap, Rated: 4A @ 125/250 VAC (-).	A	--	A	--
T	SPDT High Temperature Snap, 250°F (121°C) Continuous, Rated: 5A @ 125/250/480 VAC (-).	A	A	A	--	
V	SPDT Snap, Rated: 11A @ 125/250 VAC (-), 1/3 hp @ 125/250 VAC (-), 1/2A @ 125 VDC (±), 1/4A @ 250 VDC (±), 4A @ 125 VAC (-)(tungsten).	A	A	A	--	
W	SPDT Gold Contact Snap, Rated 0.1A @ 125 VAC (-).	A	A	A	--	

\* Potentiometer and transmitter outputs will have no switches when ordered with switch type O, 2 switches if ordered with switch types B, C, I, R, V, or W, and 4 switches if ordered with switch type S. No other switch types are available.

					Available Options "A" signifies available with corresponding construction style.			
					Mark			
					1	3	4	6
<b>Driving Method</b>	D			Direct Drive (Yoke) with Stainless Steel Visual Indicator.	A	A	A	A
	L			Lever Drive (Shaft), No Visual Indicator.	A	A	A	A
<b>Enclosure</b>		0		Aluminum, Painted Black	A	A	A	A
		1		Aluminum, Painted White Epoxy with SS trim	A	A	A	A
		2		Aluminum, Painted Red	A	A	A	A
		3		Cast Bronze (Optional Wording)	A	A	A	A
		4		Aluminum, Painted Blue	A	A	A	A
		5		Aluminum, Painted (color not yet specified)	A	A	A	A
		6		Cast 316 Stainless Steel	A	A	A	--
		7 thru 20		Aluminum, Painted (color not yet specified)	A	A	A	A
<b>Options</b>			J1	Junction Package with One 1/2" NPT Female Conduit Connection and Terminal Strip.	A	A	A	A
			J2	Junction Package with Two 1/2" NPT Female Conduit Connection and Terminal Strip.	A	A	A	A
			S	SAA Listed Flameproof	A	A	A	A
			SV1	1 Attached Solenoid Valve (Must be ordered with J1 option).	A	--	A	--
			SV2	2 Attached Solenoid Valves (Must be ordered with J2 option).	A	--	A	--
			MT	Metric Threaded Conduit Connection, M25 (M20 for optional J1 and J2 connections).	A	A	A	A
			B	Directive 94/9/EC, KEMA 03 ATEX 2391,  II 2 G EEx d IIC T6 (-20°C ≤ Tamb ≤ 70°C) (T5 (-20°C ≤ Tamb ≤ 80°C) optional wording).	A	A	A	A
			IS	Directive 94/9/EC, KEMA 03 ATEX 1392 x,  II 1 G EEx ia IIC T4.	A	A	A	--

## EXAMPLE MODEL NUMBERS

### 12VD0-J1

Mark 1, 2 Switches both Type V – SPDT, Direct Drive, Painted Aluminum Enclosure with Junction Package.

### 62PD0

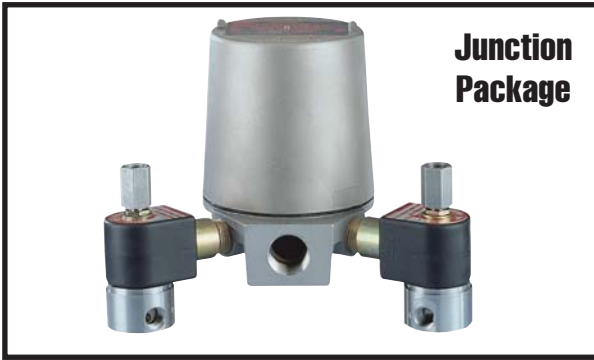
Mark 6, 2 Switches both Type P – SPST, Direct Drive, Painted Aluminum Enclosure.

### 15VD0

Mark 1, 2 Switches both Type V – SPDT, 4 to 20 mA transmitter, Direct Drive, Painted Aluminum Enclosure.

## JUNCTION PACKAGE

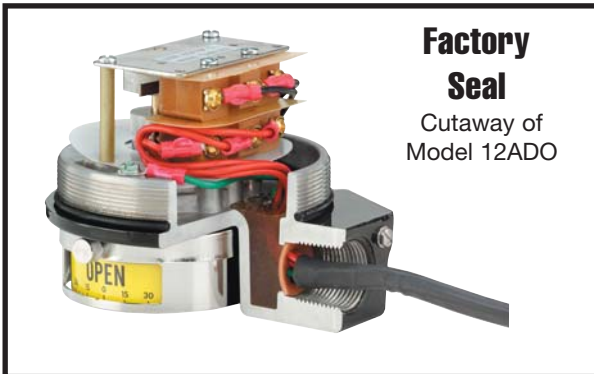
Complete factory assembled packages combine visual indication, solenoids, switches and transmitter in a single convenient UL, CSA, SAA certified or ATEX compliant assembly which saves labor and reduces cost. The simple package is shipped ready for installation, complete with optional custom designed mounting kit for your specific application. Many options are available such as painted aluminum, epoxy coated aluminum or stainless steel housings including a standard 3/4" NPT conduit entrance and choice of 1 or 2 additional 1/2" NPT conduit entrances. The optional conduit entrances are drilled and tapped in the base of the position indicator housing and solenoid valves are screwed into the entrances. 22 to 16 AWG wire leads from solenoids, switches and optional transmitter are terminated in pre-labeled, easy-access terminal strips protected inside the housing. Note: UL, CSA and SAA approval and ATEX compliance requires complete package assembly by Proximity. Consult the factory for recommended UL, CSA, SAA approved or ATEX compliant solenoid valve options. ATEX compliance is KEMA 03 ATEX 2391,  $\text{CE}$   $\text{Ex}$  II 2 G EEx d IIC T6 (-20°C ≤ Tamb ≤ 70°C) (T5 (-20°C ≤ Tamb ≤ 80°C) optional wording).



**Note:** Junction package is not available on six switch models, switch type A, D, G, H, and T models.

## FACTORY SEALED LEADS

Eliminate the possibility of conduit contamination and the need for seal fittings with Proximity's factory sealed (potted) leads. This seal has been UL tested to 6000 psi (413 bar) and is UL and CSA listed for Class I, Groups A, B, C, D; Class II, Groups E, F & G; Div. 1 & 2 locations. Groups may vary depending on the switch model. Standard leads are 18 AWG and 36" (91.44cm) long.

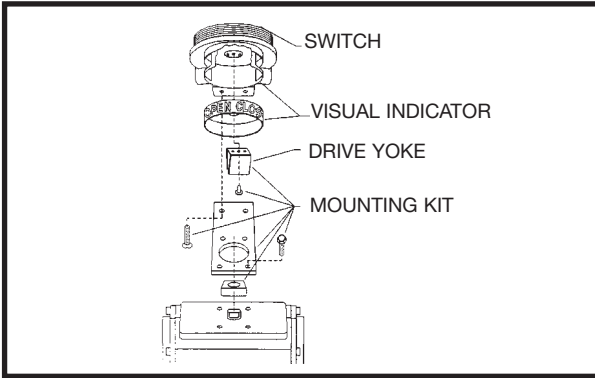


## MOUNTING KITS

Mounting kits are available for direct installation of the Proximity Mark Series onto most valve and actuator brands. Proximity Controls has over 2000 kits available and can custom make kits for any application. Each kit is specially designed for a particular actuator or valve, making field mounting simple with standard tools. Mounting kits can be used with any model in the Mark Series, since external features are identical. Rotary valve kits utilize direct drive couplings, while linear valve kits use a lever drive.

Kits include a drive yoke or slotted lever arm, bracket, and fasteners made in either zinc plated steel or stainless steel. The high strength, spring tempered, stainless steel drive yoke/coupling is tailored to fit securely to a specific valve or actuator stem ensuring that there is no slippage or binding. No special alignment fixtures are required due to switch-offset design and yoke to stem engagement that makes installation a snap.

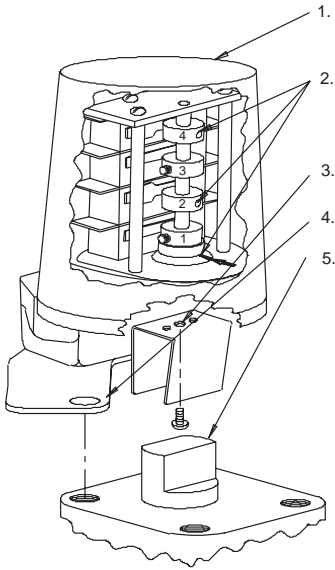
If you have purchased this unit without a mounting kit, please contact us to get the proper kit for your application.



## VISUAL INDICATOR

A stainless steel mechanical visual indicator is standard on direct drive units. The indicator provides visual open and closed indication and a degree scale, which can easily be seen from 75 feet away. The scale is adjustable in 15° increments and the windows are adjustable in a 56° range with 90° fixed increments. Factory options include 180° indication, flow path indication, special colors, and LED's.

# MARK 1 AND 4 DIRECT DRIVE INSTALLATION



## INSTALLATION PROCEDURE

1. Unscrew cover. Keep threads clean and free from damage.

2. Switches are set at factory when in counterclockwise position. Index marks should appear as shown (Mark 1 only). Set screws, or holes in manual cams, (#2, 4 and 6) on Closed switches will be directly above index marks.

2 Switch Unit	#1 Open	#2 Closed
4 Switch Unit	#1, 3 Open	#2, 4 Closed
6 Switch Unit	#1,3,5 Open	#2,4,6 Closed

3. Attach appropriate Drive Yoke onto two pins using a #6-32 screw provided. (Note: Coupling is a special spring temper yoke or solid metal block. Do not attempt to fabricate your own yokes.)

4. Attach mounting bracket (127-003 is shown) to switch housing using 1/4" screws provided.

5. With actuator shaft rotated to its counterclockwise position, spread the Drive Yoke

and slip it down onto the square (or rectangular) part of the actuator shaft. Attach bracket with two hex cap screws. Before tightening screws, operate control slowly with a wrench or power, and observe that drive shaft and drive yoke are concentric and perpendicular in complete stroke. Adjust position as required, and tighten all the mounting screws. Check concentricity and perpendicularity. Readjust per above steps as necessary.

## ADJUSTMENT PROCEDURE

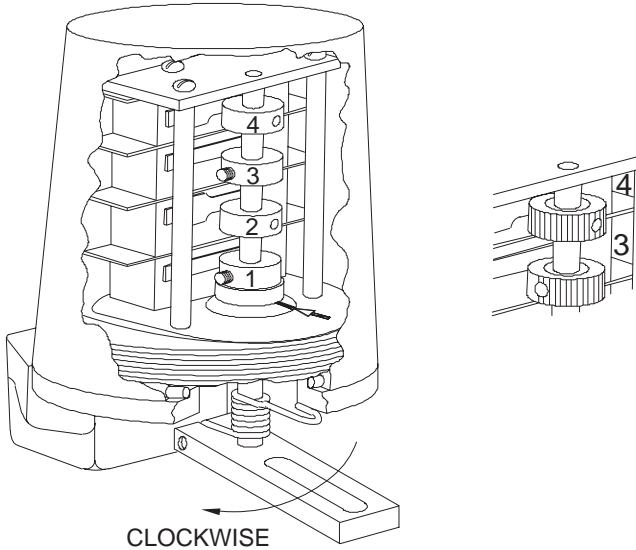
A. Using a wrench or power, rotate the actuator shaft to extreme clockwise position. All switches should change to their opposite function.

B. The cam can be relocated and repositioned by loosening the set screw. To adjust manual cams, grasp cam on knurled segment of cam surface. Simply rotate the cam on spline attached to the shaft. Feeling or sound of clicks indicates 6° incremental adjustments. Stop rotating and release pressure on cam when it is at proper actuation point. This allows cam to engage spline. Check the circuit to verify contact at proper point. Rotate shaft. Repeat steps above as necessary. Lock manual cam on spline by tightening set screw provided for additional security.

C. Screw on cover and tighten against o-ring seal until cover does not turn.

**See Pages 19-22** for wiring procedure, intrinsic safety parameters, relevant warnings and schematics.

# MARK 1 AND 4 LEVER DRIVE INSTALLATION



## INSTALLATION PROCEDURE

1. Attach proper mounting bracket to switch housing using screws provided. Tubular spacers are provided for some installations.
2. Attach appropriate driving lever onto shaft. Do not tighten.
3. Attach switch and bracket to actuator, making sure that lever is free to rotate over entire range of actuator stroke.
4. Attach driving pin or bolt through lever arm if slotted, or on driving side of solid lever. (It may be necessary to loosen or remove mounting bracket to accomplish connection on some actuators.)
5. Operate actuator very slowly and observe movement of all pins and levers to be sure there are no interferences. Slide lever up or down on switch shaft to most desirable position. When all motions are made and clearances are adequate, tighten clamp screw on lever that was left loose in step 2. Tighten all mounting screws. Recheck the travel of all levers and pins for proper clearance through the entire stroke of the actuator.
6. Unscrew cover. Keep threads clean and free from damage. Index marks are imprinted into driven magnet collar as shown (Mark 1 only). Set screws or holes in manual cams (#2, 4 and 6) will be directly above index marks on those switches that are Closed. Marks must be in line when making switch cam adjustments. Cams are set at factory when in the counterclockwise position, as shown, and listed as follows:

2 Switch Unit	#1 Open	#2 Closed
4 Switch Unit	#1, 3 Open	#2, 4 Closed
6 Switch Unit	#1, 3, 5 Open	#2, 4, 6 Closed

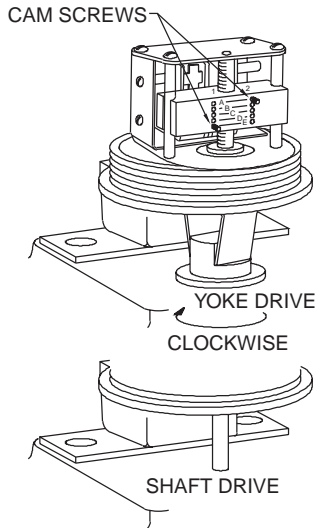
90° travel in clockwise direction will reverse all of above switch positions.

## **ADJUSTMENT PROCEDURE**

- A. Operate actuator to full closed position. Set screws hold cams in place on the shaft. For manual cams, grasp cam on knurled segment of cam surface and simply rotate cam to get correct actuation point. Clicks indicate incremental adjustments. Applying pressure on cam in direction of protruding actuation segment of cam surface, and rotating, eliminates incremental adjustments. Stop rotating and release pressure on cam when at proper actuation point. This allows engagement of cam to spline. Check circuit to verify contact at proper point. Repeat the cam adjustment steps as necessary. Lock manual cam on spline with set screw provided for additional security.
- B. Operate actuator to opposite extreme (full Open), and adjust cams to suit.
- C. Screw on cover and tighten against o-ring seal until cover does not turn.

**See Pages 19-22** for wiring procedure, intrinsic safety parameters, relevant warnings and schematics.

# MARK 3 DIRECT AND LEVER DRIVE INSTALLATION



## INSTALLATION PROCEDURE

Mount the switch as necessary, concentric and perpendicular over the rotating shaft that is to be monitored. Direct drive yokes are available in many widths and lengths to fit your needs (Yokes are fabricated from spring temper stainless steel. Do not attempt to fabricate your own yokes.) Shaft drive units require an appropriate coupling (flexible type recommended) to the shaft being monitored.

## ADJUSTING PROCEDURE

1. Remove cover by unscrewing. Take care to keep threads clean and free from damage.
2. Clockwise rotation of the yoke or shaft will move the bar up, counterclockwise moves it down. Switches are set at the factory for approximately one revolution of the yoke or shaft to actuate switch #1. Notice, that the cam screw for switch #1 is in location E. By changing that cam screw to location D, three additional revolutions of the yoke or shaft will be required to actuate #1 switch. Moving the cam screw to holes C, B or A will add three revolutions for each location moved, until 13 revolutions are required between switch #1 and 2 actuation.
3. The cam screw for switch #2 is in location A. By moving it to location B, C, D, or E, three revolutions are added for each location change.
4. Rotate the switch slowly through the full cycle several times before tightening the bolts securely. Observe the rotation for signs of yoke or shaft misalignment or binding with the actuator shaft. Correct as necessary, then tighten the mounting bolts and recheck alignment.

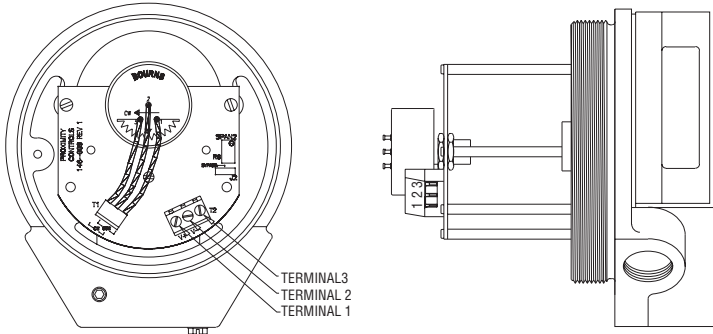
5. The following chart shows the various combinations of screw positions and resulting revolutions between switch actuation.

<b>Cam Screw Locations</b>		<b>Number of Revolutions Between Switch Actuation</b>
<b>Switch #1</b>	<b>Switch #2</b>	
E	A	1
D	D	4
C	A	7
B	A	10
A	A	13
A	B	16
A	C	19
A	D	22
A	E	25

6. Switch actuation at all intermediate number of revolutions or partial revolutions can be selected by turning the cam screws in or out when located at the nearest location shown above. Any partial number of turns may be selected, such as 4-1/2 or 12-3/4.

**See Pages 19-22** for wiring procedure, intrinsic safety parameters, relevant warnings and schematics.

# MARK 1, 3 AND 4 WITH POTENTIOMETER INSTALLATION



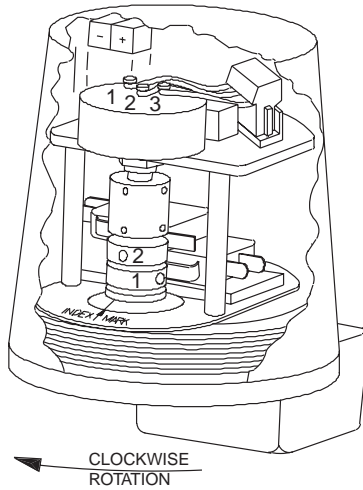
POTENTIOMETER RESISTANCE OHMS	OHMS PER DEGREE OF ROTATION	RESISTANCE BETWEEN PINS			
		NO. 2 to NO. 1		NO. 2 to NO. 3	
		CCW-SET	CW-90°	CCW-SET	CW-90°
1000	2.9	500	235	500	765
2000	5.8	1000	471	1000	1529
5000	14.7	2500	1178	2500	3823
10000	29.4	5000	2354	5000	7646
20000	58.8	10000	4708	10000	15294

## INSTALLATION AND ADJUSTMENT

- Attach the switch to the actuator or valve. Refer to Installation and Adjustment Instructions:
  - p. 9 for Direct Drive Mark 1 and 4 Models
  - p. 10-11 for Lever Drive Mark 1 and 4 Models
  - p. 12-13 for Mark 3 Models
- Remove cover by unscrewing. Take care to keep threads clean and free from damage.
- On models 13XXX and 43XXX, the switches are set at the factory when in the counterclockwise position as shown. Switch #1 is open, and #2 is closed. When cams are rotated 90° clockwise, #1 becomes closed and #2 is open. The cams may be adjusted to increase or decrease the 90° rotation. For model 33XXX refer to pages 12 and 13 for Switch Adjustment Procedure.
- The potentiometer is positioned at the factory with the resistance element approximately centered. The resistance readings in the chart are typical of each different potentiometer.
- To adjust the potentiometer to a different range, loosen the two lower set screws on the coupling. While holding the cams in the desired position, rotate the coupling and potentiometer shaft to the preferred location. Rotating clockwise reduces resistance between pins 2 and 1, and increases resistance between 2 and 3. Rotating counterclockwise increases resistance between pins 2 and 1, and reduces resistance between 2 and 3. If the resistance "jumps" rapidly, the pot is improperly rotated and functioning in the 20° dead area. Retighten the 2 set screws. A 2K span adjustment pot is provided, to activate move bypass shunt to the other pin.

**See Pages 19-22** for wiring procedure, intrinsic safety parameters, relevant warnings and schematics.

# MARK 1, 3 AND 4 WITH TRANSMITTER INSTALLATION



POTENTIOMETER RESISTANCE OHMS	OHMS PER DEGREE OF ROTATION	ROTATION RANGE			
		MARK 1 & 4		MARK 3	
		MIN	MAX	MIN	MAX
1000	2.9	50°	300°	1.5 turns	8.5 turns
2000	5.8	25°	150°	.75 turns	4.3 turns

Models 15XXX, 35XXX and 45XXX Rotary Position Indicating Switches contain a 4-20 mA Transmitter and two Single Pole Double Throw (SPDT) Micro switches. Models 150XX, 350XX and 450XX contain a 4-20 mA transmitter only, no switches.

- 4-20 mA output is fully adjustable for various rotations (zero and span). See chart above for rotation ranges using various potentiometers.
- 4-20 mA circuit is supply reversal protected and thermal protected.
- Clockwise or counterclockwise rotation corresponding to increased current output can conveniently field selected with plug connector.

## INSTALLATION AND ADJUSTMENT

1. Attach the switch to the actuator or valve. Refer to Installation and Adjustment instructions:
  - p. 9 for Direct Drive Mark 1 and 4 Models
  - p. 10-11 for Lever Drive Mark 1 and 4 Models
  - p. 12-13 for Mark 3 Models
2. Remove cover by unscrewing. Take care to keep threads clean and free from damage.
3. On models 15XXX and 45XXX, the switches are set at the factory when in the counterclockwise position as shown. Switch #1 is open, and #2 is closed. When cams are rotated 90° clockwise, #1 becomes closed and #2 is open. The cams may be adjusted to increase or decrease the 90° rotation. For model 35XXX refer to pages 12 and 13 for Switch Adjustment Procedure.

- The potentiometer is positioned at the factory with the resistance element approximately centered.

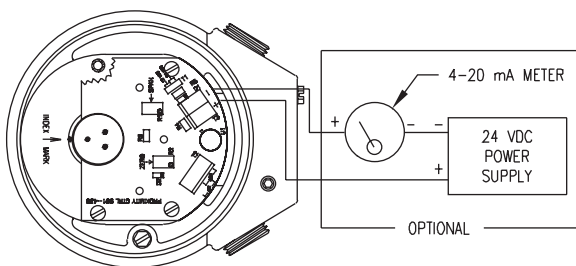
## CALIBRATION

- Set the valve at the position where you want the meter to read 0% (that is 4 mA). It may be necessary to move the plug connector to change the direction of current output to increasing for clockwise rotation or vice versa.
- On models 15XXX, loosen the two bottom set screws on the coupling. Rotate the coupling and potentiometer shaft to the position where the meter reads 0% (4 mA). Tighten two set screws.
- Turn valve to opposite position where meter should read 100% (20 mA). Use small screwdriver to adjust the blue rectangular potentiometer "span" until 100% (20 mA) is on the meter. If it is not possible to reach 100%, refer to Troubleshooting instructions.
- Return valve to original position at 0% (4mA). Use small screwdriver to adjust "zero" turning until 0% (4 mA) is read on meter. Repeat steps C & D until 4 and 20 mA read consistently on each end of stroke.

## TROUBLESHOOTING

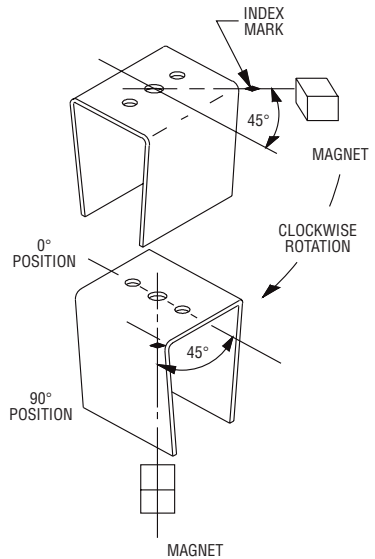
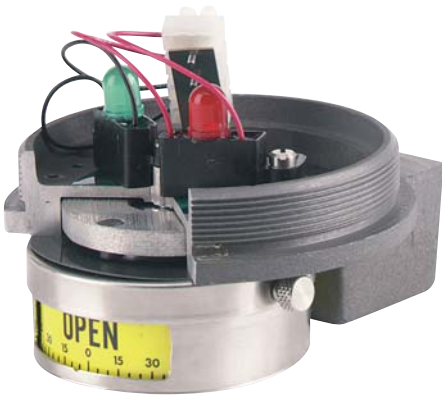
- If no current flows, check polarity of current loop (plus and minus screws on terminal strip). Also check loop resistance for open line.
- If full output current cannot be achieved by adjustment, voltage at transmitter may be too low. If so, increase power supply voltage until a minimum of 15 volts is registered or move voltage shunt to 12 VDC.
- If current increases and decreases in the wrong direction, move the plug Connector from CW to CCW or vice versa.
- Check specs to make sure you are in range of adjustment, (See chart on previous page).
- If the zero adjustment does not have enough range, the zero must be mechanically realigned as follows: Set the "zero" (fine 4 mA) adjustment to the middle of its range. (Full multi-turn range is 25 revolutions; set at 12-1/2 revolutions.) Repeat calibration steps B, C and D.

### Two Wire Connections



**See Pages 19-22** for wiring procedure, intrinsic safety parameters, relevant warnings and schematics.

# MARK 6 DIRECT AND LEVER DRIVE INSTALLATION



## INSTALLATION PROCEDURE

1. Remove cover by unscrewing. Take care to keep threads clean and free from damage.
2. Switches are set at the factory to signal each end of 90° stroke approximately as shown. The operating magnet is located between the switch cartridges on the conduit hub side, when the index mark indicating magnet position is towards the hub, as shown. (Because the magnetic field of the magnet "reaches out" about 15° on each side, the switch cartridges will be positioned about 30° greater angle than actual switching angle.)
3. The two posts on the magnet carrier are thus aligned to mate the two holes in the yoke which is shown in 0° position, Switch No. 1 will be closed.
4. By rotating the magnet carrier 90° clockwise, Switch No. 2 will close (Switch No. 1 will open). Use an ohmmeter to verify the switching points. (On switch closure, there will be 25 ohms for protection circuit.) Do not use a flashlight to test since protection circuit will not allow excessive current flow.
5. Attach the appropriate driving yoke using the #6-32 screw provided. Lever drive units use levers instead of yokes.
6. Attach switch and bracket to actuator or valve. Be sure to check and adjust the switch for perpendicularity and concentricity with the operating shaft. Rotate to opposite position and recheck perpendicularity and concentricity. Repeat the cycle several times to "eyeball" for good alignment from all angles. Readjust as necessary before tightening the bolts.
7. Increasing or decreasing the 90° throw of the switches is accomplished by loosening the center screw one turn and the wing clamp screw eight turns each. The switch cartridges can then be repositioned to 45° minimum switching or 180° maximum switching. Retighten the screws.

8. Switching angles of more than 180 degrees can be attained by rotating the magnet to the area furthest from the conduit hub, and moving the switch cartridges close together (near the conduit hub). 280 degree switching angle will result.
9. Other switching positions can be obtained by reversing the positions of the switch cartridges.
10. If yoke position does not allow switching at the angle you desire, the magnet can be repositioned in its carrier as follows:
  - a. Remove the 3 #6 screws in the bottom washer.
  - b. Lift out the magnet carrier being careful to not drop the magnet as it is loose in the carriage.
  - c. Move the magnet to the desired location.
  - d. Replace the magnet with the bottom washer and 3 screws.

**See Pages 19-22** for wiring procedure, intrinsic safety parameters, relevant warnings and schematics.

### **WIRING PROCEDURE: GENERAL**

- Complete all electrical wiring in accordance with Local and National Electrical Codes by qualified personnel
- It may be necessary to segregate power and signal circuits in separate conduit entries.
- Secure ground wire/s under grounding (earthing) screw/s provided.
- Products with flying leads shall be terminated in approved junction box.

### **WIRING PROCEDURE: HAZARDOUS LOCATIONS, FLAMEPROOF CABLE CONNECTION:**

- The cable entry device shall be certified in type of explosion protection flameproof enclosure "d" suitable for the conditions of use and correctly installed.
- For ambient temperatures above 65°C, cables and cable glands suitable for at least 95°C shall be used.

### **CONDUIT CONNECTION:**

- An Ex d, EEx d or UL and/or CSA (with appropriate classes and groups) certified sealing device such as a conduit seal with setting compound shall be provided immediately following the conduit entrance to the enclosure. UL & CSA listed factory sealed leads are provided from the factory on request.
- For ambient temperatures above 65°C, the wiring and setting compound in the conduit seal shall be suitable for at least 95°C.

### **WIRING PROCEDURE: HAZARDOUS LOCATIONS, INTRINSIC SAFETY**

- Potentiometer, Transmitter and each Switch and/or Namur Sensor must be treated as separate intrinsically safe circuits.

### **ELECTRICAL RATINGS:**

- Potentiometer, see page number 4.
- Transmitter, see page number 4
- Switches, see model chart on page numbers 5 and 6.

### **INTRINSIC SAFETY INPUT PARAMETERS: (SUFFIX "IS")**

- Potentiometer,  $U_i = 30V$ ;  $I_i = 50mA$ ;  $P_i = 0.65W$ ;  $L_i = 0mH$ ;  $C_i = 0nF$ .
- Transmitter,  $U_i = 30V$ ;  $I_i = 100mA$ ;  $P_i = 1.3W$ ;  $L_i = 0mH$ ;  $C_i = 0nF$ .
- Switches,  $U_i = 30V$ ;  $I_i = 100mA$ ;  $P_i = 1.3W$ ;  $L_i = 0mH$ ;  $C_i = 0nF$ .
- Namur Sensor,  $U_i = 16V$ ;  $I_i = 76mA$ ;  $P_i = 242mW$ ;  $L_i = 50\mu H$ ;  $C_i = 40nF$ .



### **CAUTION: GENERAL**

- Protection provided by the equipment may be impaired if the equipment is used in a manner not specified by the manufacturer.
- Risk of electric shock - disconnect supply circuit before opening. Keep unit tightly closed while circuits are alive.
- Suitable insulation between signal wiring and hazardous voltage wiring must be provided.



### **CAUTION: HAZARDOUS LOCATIONS, FLAMEPROOF**

- Keep cover tightly closed when in operation.
- De-energize supply circuit before opening.
- To prevent ignition of hazardous locations, replace cover before energizing the electrical circuits.
- After de-energizing delay 3 minutes before opening.

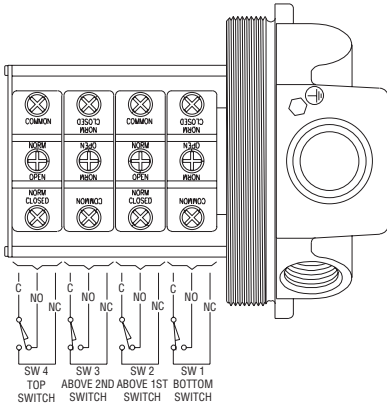
### **CAUTION: HAZARDOUS LOCATIONS, INTRINSIC SAFETY**

- Enclosure must be protected from mechanical friction and impact with iron/steel to prevent ignition capable sparks.

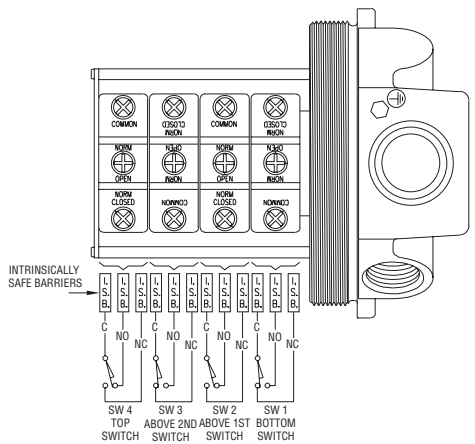
**ATTENTION:** Units without suffix B or IS are not Directive 94/9/EC (ATEX) Compliant. These units are not intended or use in potentially hazardous atmospheres in the EU. These units may be CE marked for other Directives of the EU.

**SCHEMATICS: GENERAL AND INTRINSIC SAFETY**

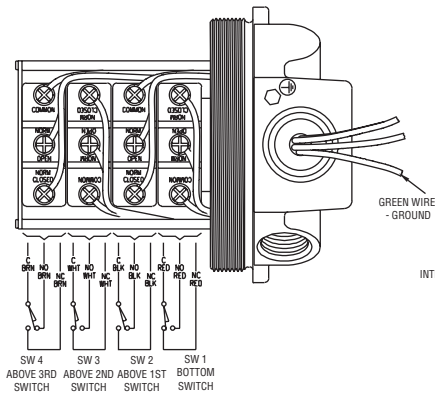
1. Units supplied with switch option A, G, H, M or T have screw terminals on the back side of the switch for terminating wires.
2. Units supplied with switch option D are supplied with 36" minimum (0.91 meters) flying leads.
3. Units supplied with switch option B, C, I, L, P, Q, R, S, V or W are supplied with terminal strips or 36" minimum (.091 meters) flying leads.
4. Units with J1 or J2 suffix are supplied with additional 2 or 4 termination points.



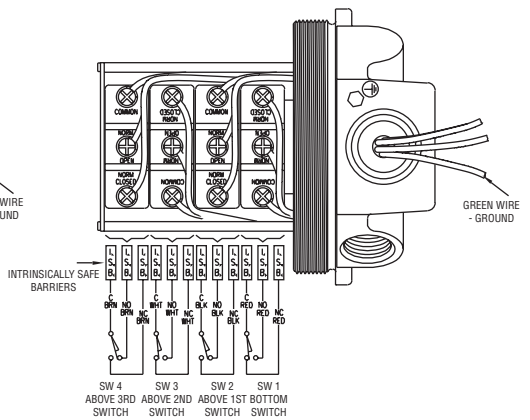
**Figure 1:** Wiring for switch types A, G, H, M, and T. 1, 2, or 4 switches.



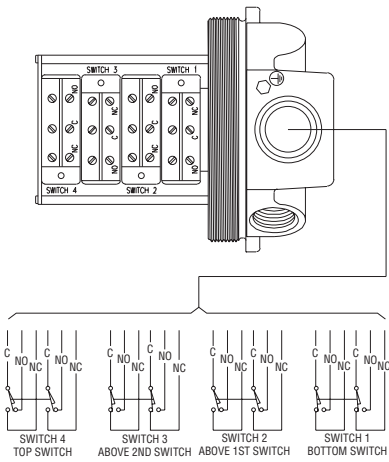
**Figure 2:** Intrinsically safe wiring for switch types A, G, H, M and T. 1, 2, or 4 switches



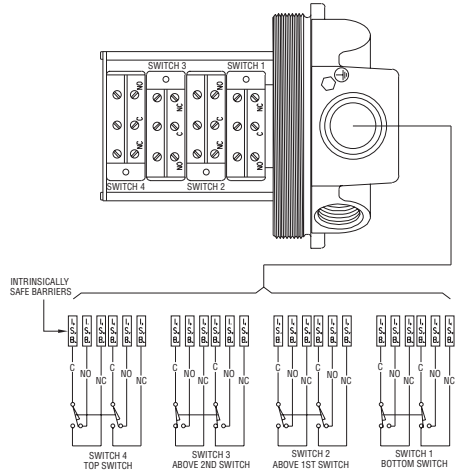
**Figure 3:** Wiring for factory sealed leads option. 1, 2, or 4 switches. Switch 1 wires are red, switch 2 wires are black, switch 3 wires are white, and switch 4 wires are brown. Wires are labeled C, NO, NC.



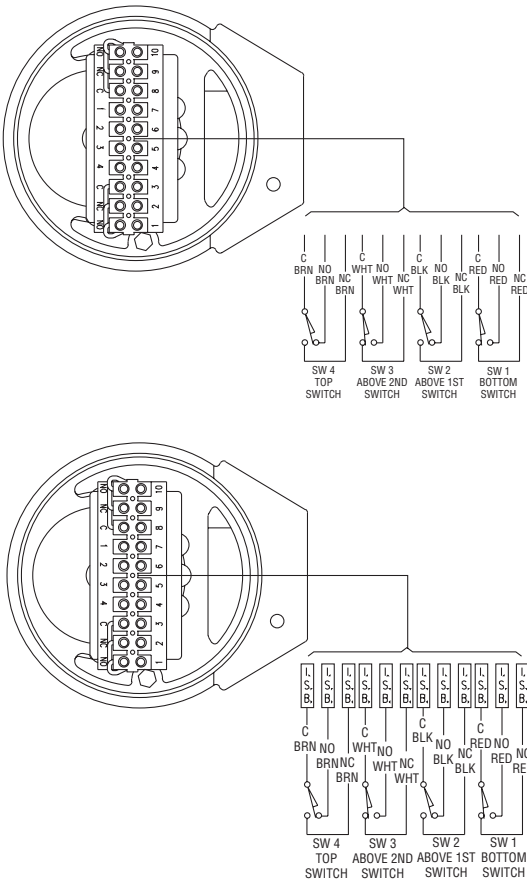
**Figure 4:** Intrinsically safe wiring for factory sealed leads option. 1, 2, or 4 switches. Switch 1 wires are red, switch 2 wires are black, switch 3 wires are white, and switch 4 wires are brown. Wires are labeled C, NO, NC.



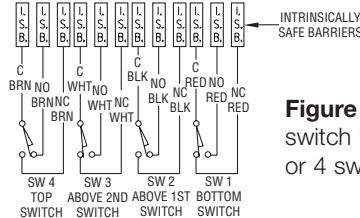
**Figure 5:** Wiring for switch type D. 1, 2, or 4 switches.



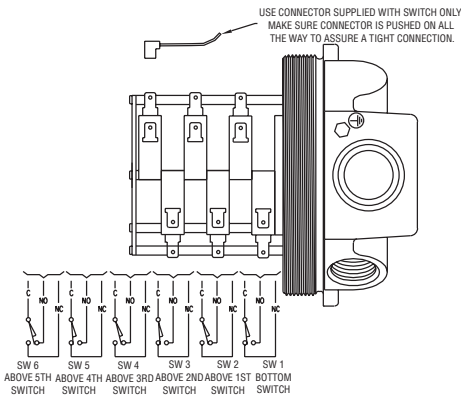
**Figure 6:** Intrinsically Safe wiring for switch type D. 1, 2, or 4 switches.



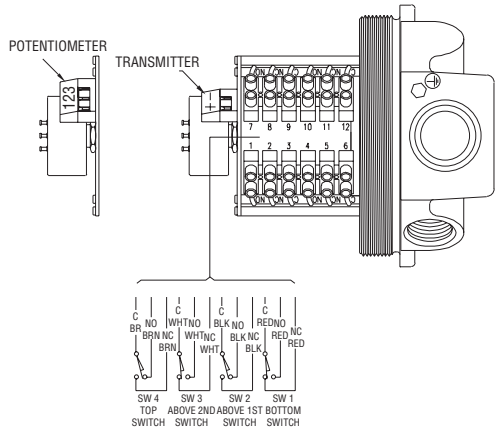
**Figure 7:** Wiring for switch types C, Q, R, V and W. 1, 2, or 4 switches.



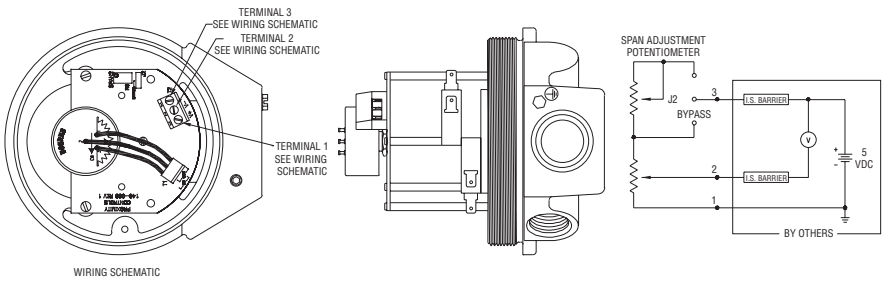
**Figure 8:** Intrinsically Safe wiring for switch types C, Q, R, V, and W. 1, 2, or 4 switches



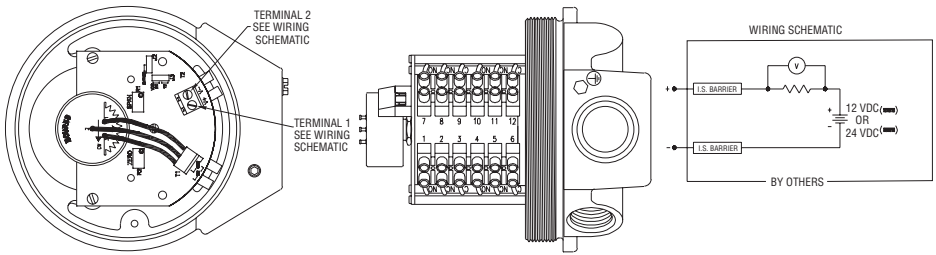
**Figure 9:** Wiring for switch types B, C, I, R, V, and W. 1, 2, 4, or 6 switches. Switch types B and I have “+” and “-” terminals.



**Figure 10:** Wiring for potentiometer and transmitter outputs. May have no switches, 4 switches of type S, or 2 switches of types B, C, I, R, V, or W.



**Figure 11:** Intrinsically Safe wiring for potentiometer output. Refer to proper switch figure if unit has switches as well.



**Figure 12:** Intrinsically Safe wiring for transmitter output. Refer to proper switch figure if unit has switches as well.

## **MAINTENANCE AND REPAIR**

The moving parts of these units need no maintenance or lubrication. Some parts are replaceable by qualified personnel, contact the factory for details. **WARNING:** Substitution of components may impair intrinsic safety of models with IS suffix. Use a damp cloth with soap and water for cleaning and decontamination. Solvents may damage O-ring seals. Units in need of repair should be returned to the following address, freight prepaid. Be sure to include a brief explanation of the problem and any relevant application information.

Proximity Controls

Attn: Repair Department

1431 State Highway 210E

Fergus Falls, MN 56537

## **LIMITED WARRANTY**

The Seller warrants all Dwyer instruments products and equipment to be free from defects in workmanship or material under normal use and service for a period of one year from date of shipment. Liability under this warranty is limited to repair or replacement F.O.B. factory of any parts which prove to be defective within that time or repayment of the purchase price at the Seller's option provided the instruments have been returned, transportation prepaid, within one year from date of purchase. All technical advice, recommendations, and services are based on technical data and information which the Seller believes to be reliable and are intended for use by persons having skill and knowledge of the business, at their own discretion. In no case is Seller liable beyond replacement of equipment F.O.B. factory for the full purchase price. This warranty does not apply if the maximum ratings label is removed or if the instrument or equipment is abused, altered, used at ratings above the maximum specified, or otherwise misused in any way.

This express limited warranty is in lieu of and excludes all other representations made by advertisements or by agents and all other warranties, both express and implied. There are no implied warranties of merchantability or fitness for a particular use for goods covered hereunder.

## **BUYER'S REMEDIES**

The buyer's exclusive and sole remedy on account of or in respect to the furnishing of non-conforming or defective material shall be to secure replacement thereof as aforesaid. The Seller shall not in any event be liable for the cost of any labor expended on any such material or from any special, direct, indirect, consequential or incidental damages to anyone by reason of the fact that it shall have been non-conforming or defective.